

ART. XLV.—*Analyses of some Apatites containing Manganese;*
by SAMUEL L. PENFIELD. (Contributions from the Sheffield
Laboratory of Yale College, No. LIX.)

IN their description of the mineral locality at Branchville, Conn. (this Journal, July, 1878), Messrs. Brush and Dana mention the occurrence of a green manganiferous apatite accompanying the other manganese minerals. Apatite occurs there of many shades of color, from those which are white and transparent to those which are dark green, and still others of a bluish shade. The green varieties occur in flat crystalline

masses imbedded in feldspar; occasionally the form of the short prism is distinct. The white variety is usually in crystals; these crystals are short prisms combined with the pyramidal and rough pinacoid planes. The prismatic planes have a fibrous appearance, although they are polished and very smooth, and the pinacoids are found on close inspection to give numerous reflections from their surfaces, when looked at obliquely and turned, showing that the crystals are made up of bundles of minute hexagonal prisms of the same length, each with a small pyramidal termination. There have also been found there a few transparent and very highly modified crystals. All the varieties examined contain manganese, as the following analyses will show.

I was led by the discovery of manganese in the apatite from Branchville, to examine the same mineral occurring at Franklin Furnace, New Jersey; manganese was also found to be present in it. This apatite occurs in crystals of a light apple-green color imbedded in calcite, from which they are readily separated.

The material employed in the four analyses, given below, was as follows:—Analysis 1 was made of a dark green variety from Branchville, the darkest that was found. It has a vitreous luster, appearing black by reflected light, but a beautiful dark green by transmitted light. Only clear transparent fragments were accepted.

Analysis 2 was made in the Sheffield Laboratory by Mr. Frederick P. Dewey, of a green variety from Branchville, lighter in color than the one just described. Analysis 3 was of the white crystallized variety from Branchville. Great care was taken to select only the crystals which have been described before as having the rough pinacoid planes. Analysis 4 was made of the crystallized variety from Franklin Furnace, N. J. The whole amount employed was taken from one large crystal. It readily separated from the calcite in which it was imbedded, and although the analysis shows the presence of carbonic acid, it was from no external admixture of calcite.

No. 1. Specific gravity, 3.39.

	I.	II.	Mean.	Ratio.	
P ₂ O ₅	41.60	41.66	41.63	2.93	1
Fe ₂ O ₃	.77		.77		
CaO	40.31		40.31	.720	} .869 2.97
MnO	10.59		10.59	.149	
Ca			3.29	.082	.28
F	3.20	3.04	3.12	.164	.56
Cl	.03		.03	.000	
			99.74		

No. 2, by Mr. F. P. Dewey.

	I.	II.	Mean.	Ratio.	
P ₂ O ₅	40.94	40.99	40.96	.288	1
Al ₂ O ₃	.52	.47	.50		
Fe ₂ O ₃	.09	.08	.08		
CaO	47.79	47.95	47.87	.855	} .890 3.09
MnO	2.50	2.47	2.48	.035	
Ca			4.04	.101	.35
F	3.84	3.84	3.84	.202	.70
Insoluble	.06	.05	.06	.000	
			99.83		

No. 3. Specific gravity, 3.144.

	I.	II.	Mean.	Ratio.	
P ₂ O ₅	41.47	41.47	41.47	.292	1
Fe ₂ O ₃	.22	.22	.22		
CaO	49.10	49.13	49.12	.877	} .905 3.01
MnO	1.98	1.94	1.96	.028	
Ca			2.88	.072	.25
F	2.68		2.68	.141	} .144 .49
Cl	.10		.10	.003	
Insoluble	1.50		1.50		
			99.93		

No. 4. Specific gravity, 3.22

	I.	II.	Mean.	Ratio.	
P ₂ O ₅	39.58	39.59	39.59	.279	1
Al ₂ O ₃	.56	.56	.56		
Fe ₂ O ₃	.77	.77	.77		
CaO	46.52	46.76	46.64	.833	} .852 3.05
MnO	1.38	1.31	1.35	.019	
ZnO	.03	.03	.03		
Ca			3.57	.089	.32
F	3.40	3.34	3.37	.177	} .178 .64
Cl	.04		.04		
CaCO ₃	2.82		2.82	.001	
H ₂ O	.52		.52		
			99.26		

The above ratios coincide very nearly with that required by the accepted formula of the species, viz: 1 : 3 : 0.33 : 0.67.

These analyses are the first that show the presence of notable quantities of manganese replacing calcium in apatites. It is also to be noted that these apatites are essentially fluor-apatites containing only a trace of chlorine.

In closing, I wish to express my thanks to Professor George J. Brush, who has kindly provided me with the material for carrying on this investigation, and to Mr. Frederick P. Dewey, whose analysis I have quoted.